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National Eutrophication Survey, Las Vegas, Nev

Prepared for

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REPORT

ON

AMERICAN FALLS RESERVOIR

BANNOCK, BINGHAM & POWER COUNTIES

IDAHO

EPA REGION X

WORKING PAPER NO. 776

WITH THE COOPERATION OF THE

IDAHO DEPARTMENT OF HEALTH AND WELFARE

AND THE

IDAHO NATIONAL GUARD

JULY, 1977

14

REPORT ON AMERICAN FALLS RESERVOIR

BANNOCK, BINGHAM & POWER COUNTIES, IDAHO

EPA REGION X

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 776

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

July 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

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Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Idaho Department of Health and Welfare for professional involvement, to the Idaho National Guard for conducting the tributary sampling phase of the Survey, and to those Idaho wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the State of Idaho Department of Health and Welfare, Division of Environment, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

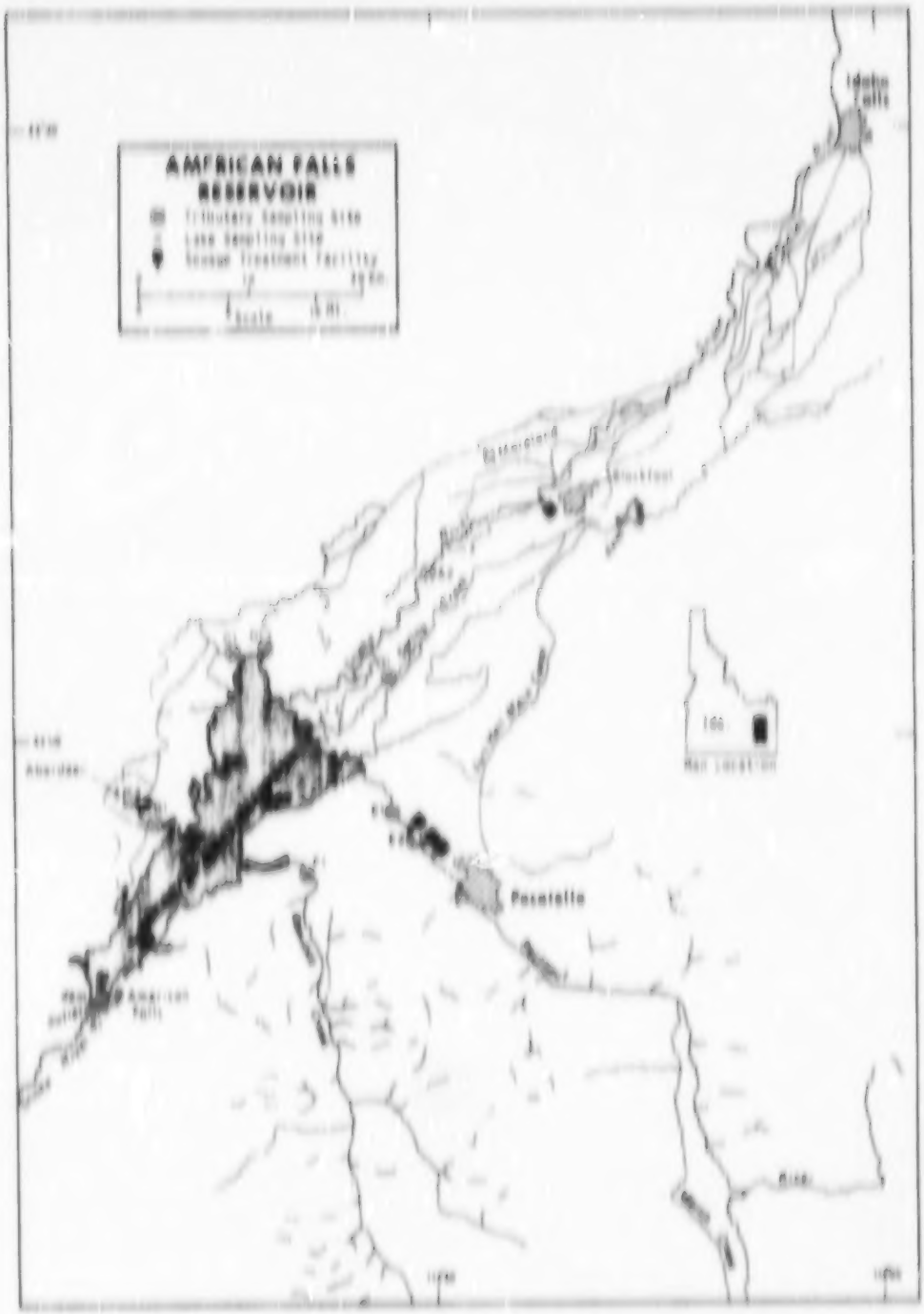
Major General James S. Brooks, Adjutant General of Idaho, and Project Officer Major Vestal L. Baker, who directed the volunteer efforts of the Idaho National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF IDAHO

LAKE NAME	COUNTY
American Falls Reservoir	Bannock, Bingham, Power
Cascade Reservoir	Valley
Coeur d'Alene Lake	Benewah, Kootenai
Dworshak Reservoir	Clearwater
Hauser Lake	Kootenai
Hayden Lake	Kootenai
Island Park Reservoir	Fremont
Lake Lowell (Deer Flat Reservoir)	Canyon
Magic Reservoir	Blaine, Camas
Palisades Reservoir	Bonneville (Lincoln in WY)
Payette Lake	Valley
Lower Twin Lake	Kootenai
Upper Twin Lake	Kootenai


AMERICAN FALLS
RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Scale
Pocatello
American
Falls

REPORT ON AMERICAN FALLS RESERVOIR, IDAHO
STORET NO. 1601

I. CONCLUSIONS

A. Trophic Condition:*

Based upon Survey data, American Falls Reservoir is considered eutrophic, i.e., nutrient rich and highly productive. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of each lake.

Nutrient levels in American Falls Reservoir were quite high: of the 13 Idaho lakes sampled in 1975, none had higher median total phosphorus or orthophosphorus values, and 1 had higher median inorganic nitrogen levels than this lake. Potential for primary productivity as measured by algal assay control yield was high. Chlorophyll a levels ranged from 5.3 ug/l to 45.1 ug/l with a mean of 18.4 ug/l.

Survey limnologists reported algal blooms at Stations 01 and 02 during August, and algal-related turbidity throughout the lake on all three sampling occasions. Other studies (Idaho Department of Natural Resources, et al., 1975; Idaho Department of Health and Welfare, 1975 and 1976) report turbidity from agricultural runoff and high bacteria levels are additional water quality problems in American Falls Reservoir.

*See Appendix I

B. Rate-Limiting Nutrient:

The algal assay results suggest American Falls Reservoir was phosphorus limited during spring sampling and colimited during fall. The lake data indicate primary limitation by nitrogen on all three sampling occasions.

C. Nutrient Controllability:

During the 1975 sampling year, point sources identified within 40 stream-km (25 miles) of American Falls Reservoir contributed 9.6% of the total phosphorus load. The Pocatello plant contributed 8.0%, Blackfoot contributed 1.4% and Aberdeen was estimated to have contributed 0.2% of the total load. In addition, substantial nutrient contributions from the city of Idaho Falls are known to impact the Snake River. Although nutrient contributions from this area are not reported in the lake nutrient budget due to the distance of Idaho Falls from the reservoir, they are included in the annual phosphorus and nitrogen loadings for the Snake River (Station A-2).

The calculated annual phosphorus loading of 2.20 g $P/m^2/yr$ is twice that proposed by Vollenweider (1975) as "eutrophic" for lakes with such volume and hydraulic retention time. The loading data suggest that elimination of contributions from known point sources would still leave high nutrient inputs, and further reduction in nutrient contributions, including nonpoint, would probably be necessary to effect lake water quality improvement.

Examination of land use practices and identification of additional point sources may provide answers to further nutrient reductions.

2. Nonpoint sources -

The mean annual phosphorus load not attributable to nearby point sources was about 90.4% of the total reaching American Falls Reservoir during the sampling year. The Snake River contributed 51.4% of the total, the Portneuf River contributed 32.2%, and ungaged drainage areas were estimated to have contributed 1.2% of the total phosphorus load.

The nutrient export rates of the Portneuf River and Spring Creek were substantially greater during the sampling year than the other gaged tributaries to American Falls Reservoir (Section IV-D). The Portneuf River is impacted by a fish hatchery (trout farm) immediately above sampling Station E-1, and several industrial ponds further upstream in Pocatello. Further sampling is needed to determine the significance and potential controllability of these unmeasured sources to American Falls Reservoir.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake surface area, mean depth and volume were provided by the U.S. Geological Survey (USGS) (1972), and Martin and Hanson (1966). Maximum depth was estimated on the basis of National Eutrophication Survey (NES) sampling data. Tributary flow data were provided by the Idaho District office of the USGS. Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in NES Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 277.03 km^2.
2. Mean depth: 9.2 meters.
3. Maximum depth: 16.8 meters.
4. Volume: 2,090.933 x 10^6 m^3.
5. Mean hydraulic retention time: 109 days.

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area (km^2)	Mean flow (m^3/sec)
A-2 Snake River	29,292.9	144.90
B-1 Unnamed Stream	271.9	1.21
D-1 Dantelson Creek	253.3	1.70
E-1 Portneuf River	3,367.0	15.80
F-1 Bannock Creek	1,020.5	1.09
G-1 Spring Creek	69.9	13.58
Minor tributuaries and immediate drainage -	670.9	3.86
Totals	34,946.4	182.14
2. Outlet - A-1 Snake River	35,224.0	222.29

C. Precipitation:

1. Year of sampling: 33.3 cm.
2. Mean annual: 27.4 cm.

III. LAKE WATER QUALITY SUMMARY

American Falls Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from five stations on the lake and from one or more depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll *a* analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 15.5 meters at Station 01, 11.6 meters at Station 02, 9.8 meters at Station 03, 6.4 meters at Station 04, and 2.4 meters at Station 05. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll *a* determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera		Algal Units per ml
05/15,16/75	1.	Cyclotella	4,656
	2.	Asterionella	2,147
	3.	Chroomonas	1,227
	4.	Diatoma	562
	5.	Nitzschia	460
		Other genera	1,279
		Total	10,531
08/05/75	1.	Aphanizomenon	3,684
	2.	Fragilaria	1,505
	3.	Melosira	415
	4.	Navicula	208
	5.	Cymbella	156
		Other genera	207
		Total	6,175
09/18/75	1.	Aphanizomenon	745
	2.	Chroomonas	348
	3.	Cryptomonas	248
	4.	Fragilaria	149
	5.	Cyclotella	99
		Other genera	100
		Total	1,689

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (ug/l)
05/15,16/75	01	17.4
	02	19.5
	03	23.5
	04	8.0
	05	6.6
08/05/75	01	24.9
	02	6.3
	03	12.5
	04	45.1
	05	****
09/18/75	01	9.4
	02	6.9
	03	13.0
	04	10.7
	05	12.5

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 05/15/75 Stations 01-03

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	<0.005	0.020	0.2
0.05 P	<0.055	0.020	2.5
0.05 P + 1.0 N	<0.055	1.020	16.2
1.00 N	<0.005	1.020	0.2

b. 09/18/75 Stations 04, 05

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.060	0.660	10.0
0.05 P	0.110	0.660	15.4
0.05 P + 1.0 N	0.110	1.660	34.7
1.00 N	0.060	1.660	14.3

F. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary productivity was low in American Falls Reservoir during spring (05/15/75) but extremely high during autumn sampling (09/18/75). In spring, the addition of orthophosphorus alone produced a significant increase in yield over that of the control, indicating the sample was phosphorus limited at that time. The addition of nitrogen alone did not result in any increase in yield over that of the control. The spring assay sample for Stations 04 and 05 was broken during shipment so is not included in this report.

In autumn, the assay for Stations 04 and 05 did not demonstrate any significant increase in yield over that of the control with the addition of either orthophosphorus or nitrogen alone, but the simultaneous addition of both nutrients produced a substantial increase in yield, suggesting colimitation by the two nutrients.

The mean inorganic nitrogen to orthophosphorus (N/P) ratios in the lake data were approximately 8/1, 3/1, and 8/1 in the spring, summer and fall, respectively, suggesting primary limitation by nitrogen in American Falls Reservoir on all sampling occasions.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Idaho National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page 1), except for the high runoff months of June and July when two samples were collected. Sampling was begun in October 1974, and was completed in September 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Idaho District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $kg/km^2/year$, in Danielson Creek and Bannock Creek, at Stations D-1 and F-1 and multiplying the means by the ZZ area in km^2.

The operators of the Blackfoot and Pocatello wastewater treatment plants provided monthly effluent samples and corresponding flow

data. Nutrient loads for the city of Aberdeen wastewater treatment plant were estimated at 1.134 kg P and 3.401 kg N/Capita/year. Nutrient loads for the Simplot and FMC plants were calculated from monthly chemistry data and flow provided by the Idaho Department of Health and Welfare, Division of Environment (Michael Smith, personal communication). It should be noted that calculated annual total nitrogen loadings do not include NO_2-N samples, and may thus be substantially underestimated.

A. Waste Sources:

1. Known municipal -

Name	Pop.* Served	Treatment*	Mean Flow ($m^3/d \times 10^3$)	Receiving Water
Blackfoot	10,000	Activated Sludge	3.816	Snake River
Pocatello	46,000	Primary Clarification	20.445	Portneuf River
Aberdeen	900	Primary Clarification	0.341**	Unnamed Stream/ Little Hole Draw

2. Known industrial - ***

Name	Product	Treatment	Mean Flow ($m^3/d \times 10^3$)	Receiving Water
J.R. Simplot	Fertilizer	Unknown	3.709	Portneuf River
FMC Corp.	Elemental Phosphorus	Unknown	7.873	Portneuf River

*Plant operators and/or U.S. EPA, 1971.
**Estimated at 0.3785 m^3/capita/day.
***Mike Smith, personal communication.

B. Annual total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Snake River	313,395	51.4
B-1 Unnamed Stream	5,295	0.9
D-1 Danielson Creek	2,265	0.4
E-1 Portneuf River	88,370	14.5
F-1 Bannock Creek	13,125	2.1
G-1 Spring Creek	9,110	1.4
b. Minor tributaries and immediate drainage (nonpoint load) -	7,380	1.2
c. Known municipal STP's -		
Blackfoot	8,535	1.4
Pocatello	48,540	8.0
Aberdeen	1,020	0.2
d. Septic tanks* -	<5	<0.1
e. Known industrial -		
Simplot	94,790	15.5
FMC	13,340	2.2
f. Direct precipitation** -	4,850	0.8
Totals	610,015	100.0%

2. Output - A-1 Snake River - 577,365

3. Net annual P accumulation - 32,650

*Estimated based on 5 lakeshore residences.
**Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Snake River	5,419,255	66.1
B-1 Unnamed Stream	36,525	0.4
D-1 Danielson Creek	90,065	1.1
E-1 Portneuf River	847,885	10.4
F-1 Bannock Creek	61,750	0.8
G-1 Spring Creek	571,225	7.0
b. Minor tributaries and immediate drainage (nonpoint load) -	139,545	1.7
c. Known municipal STP's -		
Blackfoot	19,805	0.2
Pocatello	248,260	3.0
Aberdeen	3,060	<0.1
d. Septic tanks* -	55	<0.1
e. Known industrial -		
Simplot	425,575	5.2
FMC	16,615	0.2
f. Direct precipitation** -	299,080	3.7
Totals	8,178,700	100.0%
2. Outputs - A-1 Snake River -	12,267,495	
3. Net annual N export*** -	4,088,795	

*Estimate based on 5 lakeshore residences.
**Estimated (See NES Working Paper No. 175).
***Export probably due to unmeasured point sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Snake River	11	185
Unnamed Stream	19	134
Danielson Creek	9	356
Portneuf River	26	262
Bannock Creek	13	60
Spring Creek	130	8,172

E. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
C-1 Unnamed Stream	0.209	1.715

F. Yearly Loadings:

In the following table, the existing phosphorus loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not be applicable to water bodies with very short retention times or in which light penetration is severely restricted from high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading ($g/m^2/yr$)
Estimated loading for American Falls Reservoir	2.20
Vollenweider's "eutrophic" loading	1.08
Vollenweider's "oligotrophic" loading	0.54

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

[illegible] FLOW INFORMATION FOR [illegible]

LAKE CODE [illegible] [illegible] FALLS RPS.

TOTAL DRAINAGE AREA OF LAKE(SQ MI) [illegible]

YEAR	TOTAL PRECIP (IN)	JAN	FEB	MAR	APR	MAY	MONTHLY FLOWS(CFS) JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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SUMMARY

TOTAL DRAINAGE AREA OF LAKE = [illegible]

[illegible] OF GAGED DRAINAGE AREA = [illegible]

TOTAL FLOW IN = [illegible]

TOTAL FLOW OUT = [illegible]

GAGE MONTHLY FLOWS AND DAILY FLOWS(CFS)

YEAR	MONTH	DAY	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				

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APPENDIX C

PHYSICAL AND CHEMICAL DATA

[illegible]

[illegible]

[illegible]

| | | |

[illegible] PETROLEUM DATE ANALYSIS
[illegible] FORMATION SURVEY
[illegible]

[illegible]
42 [illegible] 112 41 02.0 3
[illegible]
[illegible]

[illegible]

[illegible] RESERVOIR
[illegible] FEET [illegible] CLASS II*

DATE	TIME	DEPTH	WATER	OIL	GAS	WATER	OIL	GAS	OIL	GAS	OIL
FROM	OF		TO	THROUGH	INDUCTION	OR	T ALL	OPTIMUM	TOT LEL	HORIZONTAL	ANISOTROPIC
TO	DAY	FEET	CUT	MCF/D	INCHES	PERCENT	SO	MCF/D	MCF/D	MCF/D	MCF/D	MCF/D
75/05/24	13	35	8889	34.3	7.4	0	384	0.75	340	0.250	0.888	0.972	0.342
75/08/05	17	00	8888	34.4	12.0	44	335	0.10	347	1.040	1.500	0.1234	0.234
	17	01	9889	32.4	12.0		333	0.10	347	0.870	0.370	0.1234	0.837
75/05/24	05	30	8887	35.4	7.0	0	350	0.21	340	0.501	1.100	0.700	0.874
	05	31	9886	35.5	7.0		365	0.20	172	0.570	1.100	0.240	0.872

DATE	TIME	DEPTH	PRESSURE	OIL/WATER	GRADIENT
FROM	OF			A	OPERATING
TO	DAY	FEET	MCF/D *	BBL/D	PRESSURE
75/05/24	13	35	8888	0.721	4.4
75/08/05	17	01	8888	0.241	
	17	10	8884	0.231	
75/05/24	05	30	8881	0.354	12.4
	05	32	8884	0.324	

* VALUE FROM TO BE LESS
THAN INDICATED

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

[illegible] RETRIEVAL DATE [illegible]
[illegible] CLASSIFICATION SURVEY
[illegible] : [illegible]

[illegible]
42 46 46.8 112 52 25.7 4
SNAKE RIVER
In T.5 AMERICAN FLS
[illegible] FALLS RES [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible]
[illegible] FEET [illegible] [illegible]

DATE FROM TO	TIME OF DAY	DEPTH FEET	[illegible] MG/L	[illegible] MG/L	[illegible] MG/L	[illegible] MG/L P	[illegible] MG/L P
[illegible]	[illegible]	[illegible]	31.270	1.589	4.178	0.825	0.118
[illegible]	[illegible]	[illegible]	4.326	1.889	0.845	0.823	0.970
[illegible]	[illegible]	[illegible]	4.184	1.588	0.835	0.818	0.896
[illegible]	[illegible]	[illegible]	4.192	0.468	1.874	0.818	0.836
[illegible]	[illegible]	[illegible]	4.312	1.883	0.896	0.816	0.836
[illegible]	[illegible]	[illegible]	4.289	0.559	0.895	0.825	0.873
[illegible]	[illegible]	[illegible]	4.185	1.258	4.178	0.818	0.948
[illegible]	[illegible]	[illegible]	4.388	4.388	4.528	0.895	0.946
[illegible]	[illegible]	[illegible]	4.345	4.788	0.865	0.431	0.856
[illegible]	[illegible]	[illegible]	4.838	4.548	0.134	0.835	0.848
[illegible]	[illegible]	[illegible]	4.714	0.458	0.288	0.188	0.135
[illegible]	[illegible]	[illegible]	4.835	0.588	0.895	0.848	0.878
[illegible]	[illegible]	[illegible]	4.825	0.558	0.198	0.118	0.146
[illegible]	[illegible]	[illegible]	4.388	3.881	0.135	0.848	0.278

[illegible] RETRIEVAL DATE 79/08/25
[illegible] NUMBER=STATION NAME=
[illegible] LAT [illegible]

[illegible]
[illegible] 112 30 [illegible] =
[illegible]
[illegible] 7.5 [illegible]
[illegible] FALLS [illegible]
[illegible] BUTTE 40 [illegible] [illegible] =
[illegible]
[illegible]
[illegible] [illegible]

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FROM	OF		[illegible]	N	TOTAL	[illegible]	
TO	DAY	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
78/10/27	15	10	2.260	0.665	0.015	0.005	0.746
78/11/21	19	55	1.224	1.700	0.230	0.010	0.929
78/12/21	11	05	0.709	0.680	0.029	0.010	0.829
79/01/11	15	17	0.256	0.700	0.035	0.015	0.823
79/02/08	14	35	0.403	1.300	0.490	0.024	0.850
79/03/06	10	30	0.175	1.469	0.041	0.029	0.740
79/04/09	15	45	0.138	1.600	0.035	0.010	0.941
79/05/04	15	15	0.209	1.350	0.025	0.035	0.236
79/06/19	20	32	0.210	0.500	0.035	0.025	0.840
79/08/30	10	30	0.345	0.350	0.015	0.020	0.850
79/07/17	10	15	0.255	0.450	0.041	0.030	0.130
79/08/13	20	35	0.205	0.350	0.035	0.015	0.840
79/09/14	14	15	0.270	0.260	0.010	0.010	0.840

[illegible] WATER FUEL DATE ENVIRON
NATL QUANTIFICATION SURVEY
[illegible] 185 [illegible]

[illegible]
42 55 20.0 112 48 35.0 4
[illegible] STREAM
15 7.5 [illegible]
TAMPERICAN FALLS WEST 13847
SEC NO [illegible] 2 4E SE SE [illegible]
[illegible] 2111[illegible]
[illegible] FEET DEPTH CLASS 00

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FROM TO	OF DAY	FEET	[illegible] MG/L	[illegible] MG/L	[illegible] MG/L	[illegible] MG/L	[illegible] MG/L
74/11/21	14	21	0.672	1.500	0.370	0.340	0.110
74/11/17	14	47	1.290	2.100	0.350	0.290	0.300
74/12/15	11	31	1.440	3.400	0.770	0.315	0.400
75/01/11	10	57	0.845	2.500	0.075e	0.345	0.500
75/02/05	14	38	1.370	2.400	0.624	0.400	0.710
75/03/05	14	49	1.650	1.300	0.560	0.390	0.460
75/04/13	14	25	0.760	2.400	0.390	0.440	0.540
75/05/06	14	24	0.780	2.700	0.470		0.780
75/06/09	11	35	0.335	0.850	0.055	0.100	0.140
75/06/25	10	37	0.290	0.875	0.075	0.095	0.170
75/07/17	10	39	0.440	0.400	0.035	0.135	0.170
75/07/27	11	28	0.410	0.890	0.030	0.135	0.176
75/08/20	14	07	0.365	0.450	0.060	0.120	0.140
75/09/15	14	12	0.240	0.380	0.025	0.060	0.100

e [illegible] THAN INDICATED

STORET RETRIEVAL DATE 76/09/25
WATL DISTRIBUTION SURVEY
FROM LAKE KEOWEE

PROJECT
43 03 42.0 082 43 35.7 4
UNNAMED STREAM
SC 7.5 GREENVILLE
TOWNSHIP FALLS QES 13044
SEC 40 HWDS 2.5 MI SW OF GREENVILLE
PICKENS 21123
0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	NITRITE NITROGEN TOT (MG/L)	NITRATE NITROGEN TOT (MG/L)	AMMONIA (MG/L)	AMMONIA-NITROGEN (MG/L)	AMMONIA-NITROGEN (MG/L)
FROM TO	OF DAY	FEET	N-NITRITE	N	TOTAL	DISTILLATION	
76/10/20	14	55	0.254	0.430	0.045	0.040	0.120
76/11/11	13	25	1.290	1.700	0.173	0.040	0.100
76/12/21	10	30	0.352	1.400	0.250	0.100	0.210
75/01/11	14	30	0.490	1.700	0.170	0.045	0.100
75/02/08	15	10	0.200	2.300	0.192	0.080	0.240
75/03/08	09	01	0.375	2.300	0.275	7.047	0.195
75/04/28	10	25	1.425	1.150	0.045	0.045	0.110
75/05/24	14	30	1.250	2.300	0.115	0.045	0.110
75/06/10	10	45	0.045	1.850	0.035	0.070	0.310
75/06/30	20	45	0.085	1.400	0.060	0.045	0.105
75/07/17	10	40	0.750	0.100	0.025	0.010	0.010
75/07/31	11	40	0.070	2.300	0.035	0.120	0.190
75/08/13	10	45	0.010	1.750	0.035	0.060	0.120
75/09/04	14	45	0.030	1.000	0.025	0.040	0.060

[illegible]

[illegible]

Date	Time	Temp.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
74/11/22	14	37	0.000	0.000	0.000	0.000	0.000
74/11/11	10	05	0.000	0.000	0.000	0.000	0.000
74/12/21	11	10	0.000	0.000	0.000	0.000	0.000
75/01/11	14	21	0.000	0.000	0.000	0.000	0.000
75/02/08	15	09	0.000	0.000	0.000	0.000	0.000
75/03/05	08	50	0.000	0.000	0.000	0.000	0.000
75/04/21	10	15	0.000	0.000	0.000	0.000	0.000
75/05/10	11	40	0.000	0.000	0.000	0.000	0.000
75/06/19	10	55	0.000	0.000	0.000	0.000	0.000
75/06/21	10	37	0.000	0.000	0.000	0.000	0.000
75/07/17	10	50	0.000	0.000	0.000	0.000	0.000
75/07/31	11	55	0.000	0.000	0.000	0.000	0.000
75/08/13	10	55	0.000	0.000	0.000	0.000	0.000
75/09/24	15	09	0.000	0.000	0.000	0.000	0.000

[illegible]
[illegible]
[illegible]

[illegible]
42 32 40.0 112 [illegible] 07.0 1
[illegible]
[illegible] 7.5 [illegible]
[illegible] [illegible]
[illegible]
[illegible] [illegible]

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	OF		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
YR	DAY	FEET	MG/L	MG/L	MG/L	MG/L	MG/L
[illegible]	11	35	1.490	0.800	0.370	0.280	0.240
[illegible]	10	27	1.360	2.700	0.430	0.480	0.480
[illegible]	09	00	1.480	1.300	0.210	0.250	0.320
[illegible]	17	01	1.360	0.580	0.360	0.360	0.280
[illegible]	12	45	1.450	1.100	0.320	0.870	0.390
[illegible]	17	45	1.300	1.450	0.450	0.250	0.490
[illegible]	13	05	1.480	1.750	1.300	0.240	0.370
[illegible]	17	47	1.350	5.200	1.650	1.450	1.800
[illegible]	10	00	0.590	0.800	0.180	0.097	0.250
[illegible]	15	15	0.820	1.500	0.320	0.145	0.320
[illegible]	16	05	1.480	1.200	0.580	0.330	0.440
[illegible]	10	00	1.570	1.000	0.370	0.310	0.370
[illegible]	12	30	1.500	1.300	0.400	0.320	0.380
[illegible]	15	10	1.570	1.700	0.470	0.310	0.370

[illegible] [illegible]
[illegible]

[illegible] RETRIEVAL DATE [illegible]
WATER CONTAMINATION SURVEY
[illegible] LAKE [illegible]

[illegible]
42 31 18.0 112 54 47.0 0
[illegible]
2N 7.5 [illegible]
[illegible] FALLS 1965 [illegible]
[illegible]
[illegible] FEET [illegible] 2,455 NV

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	TOT [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	
YR	MO	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
[illegible]	11	21	1.720	1.480	1.340	1.230	1.890
[illegible]	14	14	1.840	1.780	1.855	1.235	1.870
[illegible]	16	25	1.280	1.130	1.075	1.820	1.340
[illegible]	17	51	1.340	1.880	1.025*	1.025*	
[illegible]	15	09	1.870	1.680	1.840	1.860	1.250
[illegible]	13	50	1.810	1.650	1.895	1.885	1.350
[illegible]	12	47	1.830	1.900	1.840	1.840	1.210
[illegible]	13	36	1.790	1.180	1.865	1.115	
[illegible]	10	15	1.315	1.250	1.255	1.845	1.170
[illegible]	15	30	1.525	1.860	1.075	1.850	1.280
[illegible]	17	05	1.490	1.480	1.885	1.845	1.240
[illegible]	10	19	1.420	1.580	1.810	1.830	1.270
[illegible]	12	45	1.730	1.750	1.870	1.860	1.280
[illegible]	15	00	1.540	1.500	1.270	1.920	1.240

[illegible]
[illegible]

[illegible] RETRIEVAL DATE [illegible]
[illegible] AUTHORIZATION SURVEY
[illegible] LAKE [illegible]

[illegible]
42 59 37.8 122 37 52.3 4
[illegible] CREEK
[illegible] 7.5 SEMILLON
[illegible] FALLS WES [illegible]
SEC 40 RNGE 1 4E SE .CT 4 [illegible]
[illegible]
6200 FEET SEMI- 0.495 00

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	00		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
YY	DAY	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
[illegible]	10	50	0.170	0.500	0.070	0.020	0.380
[illegible]	15	50	0.290	1.450	0.370	0.035	0.120
[illegible]	10	25	0.350	1.800	0.070	0.030	0.100
[illegible]	07	05	0.000	0.700	0.050	0.005	0.05
[illegible]	13	25	0.375	1.400	0.090	0.065	0.350
[illegible]	17	30	[illegible]	2.500	0.245	0.135	1.200
[illegible]	15	30	0.470	2.400	0.050	0.100	0.965
[illegible]	12	25	0.400	0.900	0.035	0.055	0.340
[illegible]	10	35	0.440	1.700	0.050	0.065	0.540
[illegible]	15	25	0.660	0.800	0.100	0.095	0.290
[illegible]	17	20	1.150	1.150	0.135	0.175	0.270
[illegible]	19	30	1.200	1.350	0.200	0.230	0.340
[illegible]	13	00	1.150	0.900	0.195	0.175	0.330
[illegible]	13	00	1.150	0.800	0.270	0.360	0.270

[illegible] VALUE KNOWN TO BE LESS
[illegible] INDICATED

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]										
[illegible]										
[illegible]										
[illegible]										

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
79/01/30	09	30						
[illegible]			0.370	34,200	14,470	4,880	5,800	5,340	5,570
79/02/28	21	30							
79/02/27	09	30							
[illegible]			0.350	32,000	15,000	4,100	6,400	5,670	5,980
79/02/27	15	30							
79/03/31	09	30							
[illegible]			0.340	35,500	13,000	3,900	6,100	6,110	5,600
79/03/31	20	30							
79/04/30	09	30							
[illegible]			0.190	37,000	18,000	3,450	6,400	6,050	5,850
79/04/30	20	30							
79/05/02	12	45	1.400	26,000	11,500	3,750	6,300	5,650	5,970
79/05/30	09	30							
[illegible]			0.250	36,000	18,100	4,700	7,500	5,970	5,940
79/05/30	20	00							
79/07/30	09	30							
[illegible]			0.200	38,000	19,400	3,500	6,500	5,450	5,950
79/07/30	20	30							
79/08/02	09	30							
[illegible]			0.850	40,000	20,000	4,900	6,600	5,670	5,980
79/08/02	20	30							
79/08/27	09	30							
[illegible]								5,670	5,310
79/08/27	22	30							
79/09/30	08	50							
[illegible]			0.350	35,000	17,000	5,100	7,000	5,300	5,960
79/09/30	24	00							
79/10/30	09	30							
[illegible]			0.200	43,000	22,000	4,600	7,400	5,310	5,460
79/10/30	11	30							

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1975

STATE OF IDAHO

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of Idaho lakes sampled are presented to allow direct comparison of the ranking, by parameter, of each lake relative to the others. Median total phosphorus, median inorganic nitrogen and median dissolved orthophosphorus levels are expressed in mg/l. Chlorophyll a values are expressed in ug/l. To maintain consistent rank order with the preceding parameters, the mean Secchi disc depth, in inches, is subtracted from 500. Similarly, minimum dissolved oxygen values are subtracted from 15 to create table entries.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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